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Reagan Dunn, *District 9*

Cheryle A. Broom
King County Auditor

516 Third Avenue, Room W1033
Seattle, WA 98104-3272

(206) 296-1655
TTY 296-1024

M A N A G E M E N T L E T T E R

DATE: October 9, 2006

TO: Metropolitan King County Councilmembers

FROM: Cheryle A. Broom, County Auditor

SUBJECT: Follow up on Economic Analysis of Capital Projects

Follow-up work by the King County Auditor's Office on three previous capital planning audits has focused on addressing common problems that were found in agencies' analyses of capital alternatives. The importance of this issue to county policy-makers is that the capital budgeting process involves choosing among projects whose costs can reach hundreds of millions of dollars. Failure to select the most cost-effective projects can increase the burden on tax-payers and rate-payers, and lead to the exclusion or deferral of other meritorious projects.

This management letter describes progress to date, and provides a set of principles that, if followed, will assist the agencies and the county in establishing a more rigorous, consistent, and transparent process for making capital decisions.

Several county agencies have cooperated in this effort, with a lead role taken by the Wastewater Treatment Division in developing guidelines and a model for economic analysis that can be used and adapted by other agencies. This study recommends that the Road Services and Transit Divisions of the Department of Transportation continue work on the development of their own guidelines and analytical models for economic analysis and submit the results of this work for review by the Auditor's Office in 2007.

Economic Analysis

For the purpose of this study, economic analysis refers to the processes used to compare the benefits and costs of potential project alternatives based on standardized economic assumptions (e.g., the time-value of money) in an appropriate analytical framework. Two approaches generally followed in King County for evaluating capital project alternatives are benefit-cost analysis and lifecycle cost analysis:[1]

[1] As defined in federal Office of Management and Budget Circular Number A-94 Revised.

Definitions

Benefit-Cost Analysis -- A systematic, quantitative method of assessing the desirability of projects or policies when it is important to take a long view of future effects and a broad view of possible side-effects.

Lifecycle Cost Analysis -- The overall estimated cost for a particular program alternative over the time period corresponding to the life of the program, including direct and indirect initial costs plus any periodic or continuing costs of operation and maintenance.

Introduction

In 2003, the King County Auditor's Office initiated a series of performance audits of county agencies' major capital planning processes. The first report, released in 2003, focused on the Wastewater Treatment Division, followed by the Road Services Division in 2004 and the Transit Division in 2005. Each of these performance audits raised concerns about the consistency and quality of the economic analyses used to make recommendations on major capital investment alternatives, and noted the lack of agency guidelines governing when and how such economic analyses should be performed. (See Attachment A for the summary relevant findings and recommendations from the three reports.)

All three audits were well received by both the County Executive and the respective agencies, and the formal responses to the audits concurred with the audits' findings and recommendations. Since the completion of the audits, the King County Office of Management and Budget has developed a countywide policy to standardize assumptions made in economic analysis regarding how to recognize the time value of money (the discount rate). Meanwhile, the three agencies subject to the audits, in addition to evaluating and developing guidelines, have been working with the Auditor's Office to identify and to reach agreement on the basic principles that should be included in their economic analyses.

In the three performance audits, we pointed out several instances where individual analyses did not adhere to basic principles for comparing capital alternatives, and thus we made recommendations for improvement. At the time of the audits, we did not identify a specific set of principles that should be included in all analyses nor did we provide detailed guidance on modeling practices that can be employed to address the kinds of common technical modeling errors that are typically encountered in benefit-cost and lifecycle cost analyses. During the course of our follow-up efforts, we attempted to complete the work that was started in the previous performance audits by focusing on achieving three goals:

- *Identify the basic principles that should govern the analyses of major capital investment alternatives, regardless of the agency conducting the analyses.*

- *Produce guidelines for economic analysis and templates of analytical models that adhere to accepted basic principles, and which can serve as best practice examples.*

- *Achieve more consistency, transparency, and validity in the capital planning process, while providing for a more user-friendly process for county policy-makers to utilize, understand, and test the results of agencies' analyses.*

This memorandum describes our progress to date and proposes the next steps to be followed to reach these goals.

Methodology

Over the last year we have worked with staff from the Wastewater Treatment Division on an evaluation of several iterations of the agency's guidelines for lifecycle cost analysis and a template for a lifecycle cost model. This has been a cooperative process aimed at ensuring that the guidelines for analysis address accepted basic principles and promote best practices; and that the analytical model itself be easy to use and understand, and avoid possibilities for committing technical errors. The process involved several tests of the model's use under different scenarios (such as analyses in which alternatives may have different useful lives, or in which operating costs or savings may vary among alternatives).

As work with Wastewater has progressed, other agencies have also been engaged. In July 2006 the Auditor's Office asked several agencies to review and comment on a set of basic principles that should be incorporated into agency guidelines and models, and we developed and provided to those agencies an example of an analytical model for review. In addition to a review by the county's Department of Transportation (responding on behalf of its Road Services and Transit Divisions), we received detailed feedback from the Facilities Management Division of the Department of Executive Services whose staff expressed interest in the work. We have also coordinated with County Council and King County Office of Management and Budget personnel who have capital budget responsibilities.

Outcomes from the Follow-up Study

Because the county agencies engaged in capital planning have different investment alternatives to analyze (e.g., expansion or construction of new wastewater conveyance systems, purchase or refurbishment of buses, pavement preservation or replacement), one-size-fits-all guidelines for all agencies are not feasible. Nor is it likely that a single benefit-cost model or lifecycle cost model could adequately deal with the many different alternatives that must be analyzed. For example, an analytical model for comparing the purchase of equipment alternatives would need to be constructed differently from a model for evaluating lease-versus-purchase alternatives for office space.

Nevertheless, there is a core set of basic principles that should be adhered to in economic analyses in order for the analyses to be valid. These principles can be reflected in any set of guidelines, incorporated into any model, and applied in any individual analysis. There are also features that can be included in any analytic model that can assist in achieving the third goal, listed above, of making the assumptions of the analysis transparent and the model itself more user-friendly for decision-makers.

A conclusion of our follow-up study is that the Wastewater Treatment Division has developed guidelines that address these principles and a model that employs the principles and contains other desirable features to promote understanding for decision-makers and other stakeholders. These guidelines and the model can be used as examples, and as a starting point, for the Road Services and Transit Divisions to develop their own guidelines and models.

Building upon the work completed by the Wastewater Treatment Division and the follow-up efforts of our office, the sections below provide lists of desirable components for effective

guidelines, principles, and models that can promote quality and uniformity in the county's economic analyses and transparency for decision-makers and the public.

Desirable Components of Guidelines

These components are based on the Wastewater Treatment Division's guidelines, with modifications for this study:

- Specify which projects should be subject to formal lifecycle or benefit-cost analysis.

- Identify by position title who is responsible for the analyses.

- Establish thresholds that signal when the analyses should occur or be repeated to ensure the continued validity of selected alternatives, such as:
  - During early conceptual or planning stage of project development,
  - At 30%, 60%, 90% or 100% design, as appropriate, and
  - Major decision points due to:
    - Significant scope changes,
    - Significant schedule changes, and/or
    - Significant market changes that impact availability and pricing of energy, materials, or other major cost components.

- Describe level of detail that is appropriate at each stage.

- Indicate what information should be included in the analysis and where acceptable sources for detailed cost information can be found.

- Specify the minimum steps that should be included in the analysis, such as:
  - Define a set of practical, mutually exclusive alternatives including a "status quo" alternative,
  - Define the expected planning horizon,
  - Develop cash flow estimates for each alternative,
  - Perform risk, uncertainty, and sensitivity analyses,
  - Compare alternatives, and
  - Select a preferred alternative, with documented reasons, to be recommended to decision-makers.

- Provide the major economic assumptions to be used in the analysis (e.g., discount rate, inflation rate).

- Identify and require, as appropriate, a model template, or templates, to be used for analysis (for both agency staff and consultants).

Principles

The following seven principles, if followed consistently, address many of the concerns identified in the three capital planning performance audits:

1. ***Analyses should include all of the cash flows associated with each alternative over the estimated useful lives of the alternatives.*** In some situations—ongoing costs are the same for each alternative—the threshold analyses of alternatives can omit

certain costs. However, when results of the analyses lead to proposals to county decision-makers, values should be shown in terms of net present values or annual equivalent costs, and should include all costs.[2]

2. ***If the alternatives would require financing, the model inputs should include the cash flows related to financing costs and debt service.*** A useful practice of the Wastewater Treatment Division is to conduct a sensitivity analysis showing model outputs assuming both financing and out-of-pocket payment scenarios.[3] Reporting the results of both scenarios highlights the impact of the county's relatively low (tax-subsidized) rate of borrowing.

3. ***Cash flows for future years must be discounted to reflect the time-value of money.*** This is because a dollar now is worth more than a dollar in the future, even after adjusting for inflation, because it can earn interest or other appreciation until some time in the future. Discounting is a process of calculating the present value of a future value by deducting the interest.

4. ***Results of analyses must be shown using the county's discount rate policy. The county's Office of Management and Budget has published a discount rate policy that establishes a standard rate to be used in most situations and has identified a range of rates for sensitivity analysis.*** The use of a standard discount rate, and explanations for deviations from that standard, are critical. This policy is similar to that of the federal Office of Management and Budget. The guidelines and model employed by the Wastewater Treatment Division establish a default sensitivity range using its historical financing rate at one end (the lower discount rate) and the King County Office of Management and Budget's policy standard rate at the other end (a higher discount rate representing a typical private marginal pretax rate of return).

5. ***When alternatives have different starting dates, and net present values are calculated pertaining to those dates, these net present values should then be expressed in same-year or current-year dollars by adjusting them with the inflation rate.*** The discount rate should not be used for this purpose. Alternatively, the problem encountered by confusing discounting and de-inflating can be avoided by stating the costs and savings of each alternative in current dollars (and inflating these values, as appropriate, in analyses that include inflation).

6. ***If the alternatives analyzed have different expected useful lives, a suitable methodology must be used for making a fair comparison.*** This is because there is a benefit attached to assets that have relatively longer useful lives. Failing to take this benefit into account distorts the analysis. In many cases, such alternatives can be compared by calculating an equivalent annual cost.[4] In no instance should an arbitrary cut-off be used for establishing the period of analysis.

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[2] Net Present Value refers to the future stream of benefits and costs converted into equivalent values today. This is done by assigning monetary values to benefits and costs, discounting future benefits and costs using an appropriate discount rate, and subtracting the sum total of discounted costs from the sum total of discounted benefits.

[3] Sensitivity analysis refers to changing assumptions to see how sensitive the outcomes are to changes in the assumptions. The assumptions that deserve the most attention are those that have the largest effect on the comparison of the outcomes.

[4] A stream of equivalent annual costs that produces the same net present value as the actual cash flows of an alternative when calculated over the estimated useful life of the alternative.

7. ***If costs and benefits are subject to different inflation rates, the analysis should be based on inflated cash flows.*** This can occur, for example, in a situation where energy costs are escalating at a rate greater than labor costs. In analyses where inflation is included, the nominal discount rate should be used. In analyses where inflation can be omitted, the real discount rate should be used.[5]

Model Features

Although the work involved in conducting economic analyses of alternatives can be complex, the presentation of the results of the analysis can be straightforward. Typically, such a presentation will describe the alternatives that were considered and show how they compare in terms of net present values or annual equivalent costs.

Decision-makers and county staff who have oversight responsibilities may want more information about the estimates and assumptions that were used in the analysis after reviewing the county agency's cost comparison. They may further want to know how sensitive the outcome of the analysis is to possible changes in the estimates and assumptions. In order to assist them to fulfill these responsibilities, desirable features for any model should include:

- Instructions for how to use the model;
- Identification and listing of the major assumptions and variables (such as the discount rate, financing rate, inflation rate(s)); and
- The ability to easily conduct sensitivity analysis by making changes to the major assumptions.

(See Attachment B for an example of two tables from a model summary sheet that reflect the second and third desirable features indicated above.)

Next Steps

The Wastewater Treatment Division will be employing its guidelines and model over the coming year and making modifications as needed based on experience. For example, the division is experimenting with ways to incorporate risk analysis into lifecycle cost analysis and will be refining the process over time. Meanwhile, the Facilities Management Division has been testing a model developed by the Auditor's Office as part of this study (a model similar to the one developed by Wastewater Treatment Division), and may employ it in some future analyses.

For their part, the Road Services and Transit Divisions have been following the work of the Wastewater Treatment Division and our office, and have indicated that they plan to take advantage of this work in developing their own guidelines and models, and in response to the recommendations from the previous audits.

As part of this ongoing process, we anticipate that several of the agencies that have cooperated during the course of this study will be sharing specific applications of models as analytical

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[5] If an analysis uses constant-dollar values, then the discount rate should be calculated as: $R_n = (1 + R_r)(1 + R_i) - 1 = R_r + R_i + R_rR_i$ where, R_n is nominal rate, R_r is real rate and R_i is inflation, thereby subtracting expected inflation from the nominal discount rate. Solving for the real rate, $R_r = [(1 + R_n) / (1 + R_i)] – 1$ (Source: King County Office of Management and Budget).

questions and other issues arise, and as opportunities present themselves for sharing conceptual insights.

Recommendation

The Road Services and Transit Divisions of the Department of Transportation should complete their work on the development of guidelines for economic analysis and development of models that follow those guidelines, and submit the results of this work for review by the Auditor's Office by the end of June 2007.

Executive Response

The Executive concurs with the recommendation and indicates that the principles developed for the Wastewater Treatment Division will be used to guide the efforts of the Road Services and Transit Divison.

Bob Thomas, Senior Principal Management Auditor, and Rob McGowan, Principal Management Auditor, conducted this study. Please contact Bob Thomas or me at 296-1655 if you have any questions about the issues discussed in this letter.

Attachment A: Summary of Findings and Recommendations Related to Economic Analysis from Previous Capital Planning Performance Audits
Attachment B: Summary Sheet from an Example Lifecycle Cost Model
Attachment C: Executive Response

Econ Analysis MLtr FINAL.doc 2006-07

cc: Kurt Triplett, Chief of Staff, County Executive Office
Pam Bissonnette, Director, Department of Natural Resources and Parks (DNRP)
Don Theiler, Division Director, Wastewater Treatment Division (WTD), DNRP
Tom Lienesch, Economist, WTD, DNRP
Harold Taniguchi, Director, Department of Transportation (DOT)
Kevin Desmond, General Manager, Transit Division, DOT
Jill Krecklow, Finance and Administrative Services Manager, Transit Division, DOT
Linda Dougherty, Division Director, Road Services Division (RSD), DOT
Jennifer Lindwall, CIP and Planning Section Manager, RSD, DOT
Bob Cowan, Budget Director, Office of Management and Budget (OMB)
Sid Bender, CIP & Technology Supervisor, OMB
Chris Bushnell, Economist, OMB
Dave Lawson, Manager, Executive Audit Services

ATTACHMENT A

Summary of Findings and Recommendations Related to Economic Analysis from Previous Capital Planning Performance Audits

Performance Audit of Wastewater Treatment Division Capital Planning, 2003

Summary Finding

Guidelines for conducting financial/lifecycle cost analysis are lacking, analytical approaches to analyzing project cost are inconsistent and in some instances flawed, and the Wastewater Treatment Division (and county government as a whole) does not have a policy for determining the time value of money in economic analyses.

Recommendation

The Wastewater Treatment Division should establish guidelines and models for conducting economic analysis of capital project alternatives. In addition, the Office of Management and Budget needs to develop and implement a countywide policy for calculating the time value of money.

Performance Audit of Road Services Division Capital Planning, 2004

Summary Finding

The Road Services Division lacks an approach to ensure consistent methods are used for conducting economic analysis of potential projects. Important analytic assumptions can be omitted or left to the discretion of private consultants that conduct analysis on behalf of the county. Therefore, the county has no guarantee that the estimated costs of pending projects are comparable program-wide, that they reflect the total lifecycle costs of projects to tax-payers, or that they are consistent with the county's overall transportation goals.

Recommendations

The Road Services Division should provide guidelines for Lifecycle Cost Analysis and Benefit-Cost Analysis, particularly for the assumptions used for key cost variables such as the discount rate and vehicle wait times.

The Road Services Division should develop guidelines for how operations and maintenance costs should be included in analysis of major road project design alternatives.

ATTACHMENT A (Continued)

Performance Audit of Transit Capital Planning and Management, 2005

Summary Finding

Transit generally does not have policies, procedures, or guidelines governing the use of economic analysis of proposed capital projects. In addition, Transit is inconsistent in following best practices for identifying, quantifying, and analyzing the cost impacts of alternatives for major capital investments.

Recommendation

The Transit Division should develop guidelines and models for conducting economic analysis of capital projects and consistently follow those guidelines.

ATTACHMENT B

Example Assumptions and Output Tables from the Lifecycle Cost Analysis Model Developed by KCAO for this Study

Life-Cycle Cost Model Assumptions

Yellow-shaded areas represent variables that can be changed.
Gray-shaded areas are calculations or references to other worksheets.
These assumptions apply to all alternatives.

				Defaults
Real Discount Rate	7.0%			7.0%
General Inflation Rate	3.0%			3.0%
Nominal Discount Rate	10.2%			
Real Financing Rate	2.18%			
Nominal Financing Rate	5.25%			
Period of Financing (yrs)	20			
Financing Transaction Rate	1.0%			1.0%
Additional Inflation Rates				
Include Inflation in Analysis?	Yes	←	Yes or No	Yes
Finance Capital Outlay?	Yes	←	Yes or No	Yes

ATTACHMENT B (Continued)

Alternative Useful Lives and Model Summary Outputs

For each alternative, enter the expected useful live in the corresponding yellow-shaded cell. These assumptions can be varied for purposes of conducting sensitivity analysis.

ALTERNATIVES	Expected Useful Live <= 50 yrs	Period of Analysis	NPV Period of Analysis	Annual Equivalent	Rank 1 = Best
A	20	40	$6,677,083	$515,868	**1**
B	25	40	$7,932,637	$612,871	**2**
C	30	40	$8,912,722	$688,592	**3**
D	35	40	$9,465,684	$731,313	**5**
E	40	40	$9,285,677	$717,406	**4**

Useful life must be >= period of financing and <= 50 yrs

ATTACHMENT C

Executive Response

King County
Ron Sims
King County Executive
701 Fifth Avenue, Suite 3210
Seattle, WA 98104
206-296-4040 Fax 206-296-0194
TTY Relay: 711
www.metrokc.gov

October 4, 2006

Cheryle A. Broom
King County Auditor
Room 1033
COURTHOUSE

Dear Ms. Broom:

Thank you for the opportunity to respond to your proposed final report, Follow-up on Economic Analysis of Capital Projects, dated September 20, 2006. My staff and I appreciate the collaborative and professional approach taken by the audit staff. We look forward to the opportunity to work with the audit staff as we implement the recommendations of the audit. This letter and the enclosure respond to the findings and recommendations discussed in the proposed final report.

I generally agree with the findings and concur with the recommendations. I appreciate the auditor's acknowledgement that while county agencies have different investment alternatives that there is a core set of basic principles that all agencies can follow. The work that has been completed with Wastewater Treatment Division (WTD) provides a sound basis for us to expand the use of the policies to the Road Services and Transit Divisions. Staff from the Department of Transportation participated in the development of the financial models being used in WTD.

Both the Road Services and Transit divisions are ready to begin implementing a systematic approach to economic analysis for capital projects. In addition, both divisions will be working with the Office of Management and Budget to ensure that the guidelines used are consistent with the direction that the county is moving to strengthen the use of economic analysis in capital program decision-making

The enclosure includes the recommendations contained in the auditor's proposed final report and our responses. If you require additional information or have any further questions, please contact Harold Taniguchi, Director, Department of Transportation, at 206-684-1481.

Sincerely,

Ron Sims
King County Executive

Enclosure

cc: Kurt Triplett, Chief of Staff, Office of the King County Executive
Bob Cowan, Director, Office of Management and Budget (OMB)
Sid Bender, CIP & Technology Supervisor, OMB
Chris Bushnell, Economist, OMB
David Lawson, Manager, Executive Audit Services
Harold Taniguchi, Director, Department of Transportation (DOT)
Kevin Desmond, General Manager, Transit Division, DOT
Jill Krecklow, Finance and Administrative Services Manager, Transit Division, DOT
Linda Dougherty, Division Director, Road Services Division (RSD), DOT
Jennifer Lindwall, CIP and Planning Section Manager, RSD, DOT

Recommendation	Agency Position	Schedule for Implementation	Comments
The Road Services and Transit Divisions of the Department of Transportation should complete their work on the development of guidelines for economic analysis and development of models that follow those guidelines, and submit the results of this work for review by the Auditor's Office by the end of June, 2007	Concur	Using the economic guidelines developed by Wastewater Treatment Division, the Road Services and Transit Divisions will implement economic guidelines for their capital programs. The principles developed for Wastewater Treatment Division will be used to guide this effort. Where applicable, existing models will be used. Draft Economic Guidelines will be submitted for each program no later than June, 2007.	

ATTACHMENT C (Continued)